PATENT SPECIFICATION (11) 1 561 813

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(21) Application No. 42277/76 (22) Filed 12 Oct. 1976
(31) Convention Application No. 622 029 (32) Filed 14 Oct. 1975 in
(33) United States of America (US)
(44) Complete Specification published 5 March 1980
(51) INT. CL.³ B60S 1/44 1/18
(52) Index at acceptance
A4F 24B2A4
F2K 4B1B 4B6

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(19)

(54) WINDSCREEN WIPER TRANSMISSIONS

(71) We, TRICO PRODUCTS CORPORATION, a corporation organised and existing under the laws of the State of New York, United States of America, of 817 Washington Street, Buffalo, New York 14203, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to improvements in windscreen wiper transmissions, and more particularly to transmissions having oscillating pivot shafts for producing substantially quadrilateral wiping patterns. British Patent 1,304,469 discloses a single chain mechanism disposed at the outer end of a wiper arm for a similar purpose. There are also known windscreen wiper systems which utilise a pair of chains disposed in parallelism to accomplish this result.

In chain drive mechanisms, because of manufacturing tolerances and the fixed length of the chain links, it is advisable to provide means for adjusting the tension on the chain for proper operation. It also becomes advisable from time to time to adjust the tension on the chain because of wear on the mechanism. In certain of the above-mentioned dual chain drive mechanisms of the prior art resilient belts are used, and in others no means are disclosed for chain adjustments.

An efficient method for properly tensioning the chain is to provide a longitudinally adjustable support which engages the chain at its extremities; however, with two chains and two chain drives in parallel on a single lever such an adjustment is not feasible as each chain in most cases will require individual adjustment.

Provision of a chain drive and gearing at the outer end of the arm, as shown in the above-mentioned British Patent 1,304,469, increases the momentum to such an extent that interference with reversal and damage to the motor could occur at the end of the arm stroke upon reversal of direction.

According to the present invention in a windscreen wiper drive assembly, for use in oscillating a wiper arm and a drag link which are pivotally connected at their outer ends to respective ends of a link which is itself maintained in constant angular orientation relative to a wiper blade, the drive assembly comprises a support, a chain anchor fixed to said support, a prime mover having an oscillating output, a lever operatively connected adjacent its one end to said output for oscillatory movement about an axis coaxial with that of an arcuate part of said chain anchor, a pivot shaft rotatably mounted on said lever adjacent its other end, chain means secured to said chain anchor and operatively connected to said pivot shaft for causing oscillation of said pivot shaft relative to said lever when said lever is oscillating, means for securing the inner end of a radially extending wiper arm to said pivot shaft for movement therewith, a radially extending crank arm pivotally mounted adjacent its one end on said lever for rotation about an axis coaxial with the axis of rotation of said pivot shaft, torque transmitting gear means operatively connecting said pivot shaft to said crank arm for effecting oscillation of said crank arm relative to said lever and said pivot shaft when said pivot shaft is oscillating relative to said lever to thereby maintain a constant angular orientation of said crank arm throughout its path relative to a fixed line, and means for pivotally securing the inner end of a radially extending drag link to said crank

arm adjacent its other end, whereby the effective length of the wiper arm is a multiple of its true length to thereby increase the radius of the wiping path to produce a substantially quadrilateral wiping pattern.

In a preferred embodiment of the present invention the lever, oscillated by the output of a wiper motor, is in the form of a two part casing in which the parts are longitudinally adjustable relative to each other. The chain anchor, coaxial with the oscillating axis of the lever, is rigidly secured to the support and is enclosed by an upper part of the lever casing. The lower part of the lever casing rotatably carries the pivot shaft, which has a chain sprocket fixed thereto for rotation therewith. Gearing is provided for transmitting torque from the pivot shaft to the crank arm. The crank arm is oscillatable about an axis coaxial with the pivot shaft but relatively to the pivot shaft.

Preferably, a single chain anchored at its ends is looped around the sprocket which drives the pivot shaft. The sprocket through idler gearing drives a gear secured to the crank arm. The chain anchor is arcuate and is attached to a supporting bracket in a manner that permits angular adjustment of the chain anchor which in turn adjusts the park position. Moreover, because only a single chain is employed in combination with gearing, it is possible to adjust the tension of the chain by lengthening or shortening adjustment of the lever, and to utilise a rigid link chain rather than a resilient chain for positive and accurate operation.

A wiper arm and a drag link are each pivotally connected at their outer ends to a link about axes which are spaced apart a distance equal to the distance between the axis of the pivot shaft about which the wiper arm pivots and the axis of the crank arm about which the drag link pivots. With the wiper arm and drag link so attached a substantially rectangular wiping patern is achieved. The result of the arrangement described is to generate a wiping pattern equivalent to that produced by a wiper arm having an effective wiper arm length which is a multiple of the actual arm length. This results in a pattern having a relatively large radius and thus a small curvature at the windscreen.

The invention will be further described, by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a partial perspective view of a motor vehicle employing the improved windscreen wiper drive assembly;

Figure 2 is an enlarged perspective view, partly broken away, of the wiper drive assembly;

Figure 3 is a side view of the drive assembly shown partly in section and partly broken away;

Figure 4 is a front view of part of the drive assembly shown partly broken away; and

Figure 5 is an exploded perspective view of part of the drive assembly.

In Figure 1 there is shown a portion of a motor vehicle 10 having a windscreen 12 with a wiper set 14 mounted on the firewall (not shown) of the vehicle below the windscreen. The wiper set includes a wiper blade 16, a main wiper arm 18, a drag link or auxiliary arm 20 and a wiper transmission mechanism 22 which includes a support assembly 24 and is driven by a fluid operated reciprocating motor 25 (best shown in Figure 5) which may be of the air or vacuum type. It will of course be understood that in accordance with the broader aspects of the invention any suitable type of prime mover having as oscillating output may be employed.

The wiper transmission mechanism 22 includes a lever arm 26 in the form of a housing which includes an upper body 26*a* and a lower body 26*b*. The upper and lower bodies 26*a* and 26*b* include base plates 28*a* and 28*b*, respectively, having peripheral flanges 30*a* and 30*b*, respectively, and rear covers 32*a* and 32*b*, respectively. The upper and lower bodies 26*a* and 26*b* are secured together for longitudinal adjustment relative to each other by a pair of clamping screws 34 which are received in threaded apertures 36 in the base plate 28*b* of the lower body. The clamping screws 34 extend through axially extending elongated apertures 38 in the base plate 28*a* of the upper body 26*a*, the slots 38 being in alignment with the threaded apertures 36. A lug 40 having a threaded aperture protrudes outwardly from the base plate 28*a* and threadably receives an adjusting screw or tightening screw 42. A shoulder 44 is formed on the base 28*b* of the lower body 26*b* in opposition to the lug 40 and is positioned to engage the end of the tightening screw 42. When the clamping screws 34 are losened the upper and lower housing bodies 26*a* and 26*b* can be adjusted longitudinally relative to each other and maintained in longitudinal adjustment by movement of the adjusting or tightening screw 42. As it is moved downwardly it engages the shoulder 44 on the lower body 26*b* and drives the lower body 26*b* downward relative to the upper housing body 26*a*. A jam nut 46 is provided to retain the adjusting screw 42 in adjusted position. Tightening of the clamping screws 34 retains the upper and lower bodies 26*a* and 26*b* in adjusted position

relative to each other.

As best seen in Figure 5, the support assembly 24 includes a mounting plate 48 and an adjustment plate 50. The mounting plate 48 has an opening 52 therethrough in alignment with an opening 54 in the adjustment plate 50. Openings 52 and 54 are disposed in alignment with an opening 56 in the rear cover plate 32*a* of the upper housing body 26*a*. A chain anchor 58, having a circular periphery apart from a protruding flattened chain anchoring lug portion 59, includes a hub 60 which is concentric with the arcuate part of the periphery, extends through the openings 56 and 52 and is fixedly secured to the adjustment plate 50 in any suitable or desirable manner as, for example, by rivets 62 as shown in Figure 3. An axially extending sleeve 64 is provided centrally of chain anchor 58 and rotatably receives an output shaft 70 of motor 25. The output shaft 70 extends through aperture 54 in adjustment plate 50 and aperture 52 in support plate 48. The motor 25 is rigidly mounted on support plate 48 on the side opposite the chain anchor 58. The adjustment plate 50 includes an arcuate slot 66 adjacent the end opposite the aperture 54 and is in alignment with an opening 68 through support plate 48. A screw 71 extends through aperture 68, lock washer 72; aperture 66, washer 74 and a threadably engaging nut 76. When the nut 76 is loosened the adjustment plate 50 can be rotated about the output shaft 70 to vary the position of lug 59 for a purpose to be explained hereinafter.

In order to oscillate the lever 26 the motor shaft 70 extends into a splined aperture 80 adjacent the end of upper body 26*a* and is rigidly secured thereto. The upper body 26*a* engages rear closure plate 32*a* and encloses chain anchor 58 therein. Adjacent the lower end of lower body 26*b* a bearing boss 82 is formed thereon and protrudes from the base plate 28*b*. Similarly a bearing boss 84 is formed and protrudes rearwardly from the rear cover 32*b* of lower body 26*b* and is coaxial with the bearing boss 82. The bearing boss 82 has a journal bearing 86 press fitted therein and the bearing boss 84 has a journal bearing 88 press fitted therein. A hollow shaft 90 having an internal press fitted bearing 92 is journalled in bearing 86 and extends from the internal portion of the lower body 26*b* adjacent the base plate 28*b* through the boss 82 and projects externally thereof. A crank arm 94 is press fitted to the outer end of the hollow shaft 90 and rotates therewith. At its inner end within the lower housing 26*b* a driven gear 96 is press fitted to the hollow shaft 90 for rotation therewith. Thus when the gear 96 is rotated the hollow shaft 90 and crank arm 94 rotate with it. Journalled within the internal bearing 92 of hollow shaft 90 and coaxial therewith is a pivot shaft 98 which extends through bearing 88 in boss 84 of rear cover plate 32*b* of lower body 26*b*. The end of pivot shaft 98 is journalled in bearing 88.

A co-ordinating gear assembly 104 is splined to pivot shaft 98 within the lower housing 26*b* and is enclosed by the rear cover member 32*b*. The co-ordinating gear assembly 104 includes a driving gear 105 spaced from a chain sprocket 100 by a hub 102 which serves as a spacer. The sprocket 100 is riveted to the driving gear 105. A pivot shaft lever 106 is splined to pivot shaft 98 externally of the boss 82. An axially extending drive burr 108 is rigidly secured thereto for fixedly mounting the wiper arm for movement with the shaft lever 106. An auxiliary pivot shaft 109 extends from the free end of crank arm 94 and carries a drag link lever 110. A drag link drive burr 112 extends axially and is pivotally mounted on the free end of drag link lever 110. An auxiliary link 114 connects the drag link lever 110 and the pivot shaft lever 106. The connections between the link 114 and the levers 110 and 106 are pivotal connections.

A link chain 116 has an end connected to the lug 59 of chain anchor 58. The chain 116 is then looped around and engages the teeth of chain sprocket 100, its other end being also connected to the lug 59. An idler shaft 118 is splined to a boss 119 in the lower body base plate 28*b* at one end and is secured within an internally extending boss 121 formed in the lower housing cover member 32*b* providing a fixed position shaft. An idler gear assembly comprising first and second idler gears 120 and 122 are fixed together either as a unitary structure as shown or by riveting or in any suitable or desirable manner, and rotatably mounted on idler shaft 118. Idler gears 120 and 122 mesh with co-ordinating gear 105 and gear 96, respectively. Idler gears 120 and 122 transmit torque from the pivot shaft 98 which oscillates the wiper arm drive lever 106 to hollow shaft 90 which oscillates the crank arm 94. The gear ratios are so selected as to cause the crank arm to oscillate at a speed different from but relative to the lever arm 26 and the pivot shaft 98 so that its angular orientation is maintained fixed relative to a fixed line. In the example shown it is maintained horizontal to provide a substantially rectangular wiping pattern.

In the example shown the distance between the pivotal axes of the auxiliary

pivot shaft 109 and the pivot shaft 98 is maintained equal to the distance between the axes of the drag link drive burr 112 and the wiper arm drive burr 108. The arm and drag link shown (in Figure 1) includes a link 124 pivotally connected at each end to the outer end of the drag link 20 and the outer end of the wiper arm 18. The distance between the axes of the pivotal connections of the link 124 with the drag link and arm respectively is equal to the distance between the pivotal axes of the pivot shaft 98 and the auxiliary pivot shaft 109, so that the wiper arm and drag link remain parallel to each other throughout the wiping pattern; because this forms a parallelogram linkage the wiper arm moves in a path with its longitudinal axis parallel to the drag link at all times. By varying the ratio of the distance between the pivotal connections of link 124, and the distance between pivot shafts 98 and 109, the wiping pattern can be varied from a substantially rectangular pattern to a substantially trapazoidal pattern. As shown, a rectangular pattern is provided but it will be understood, of course, that the drag link and wiper arm may be so oriented relative to one another as to provide diverse substantially quadrilateral configurations.

Operation

In operation the wiper drive assembly of a preferred embodiment of this invention wipes a pattern that would require a 7 foot wiper arm but accomplishes this with a 19 inch wiper arm because of its unique construction. The lever arm 26 oscillates about the axis of the motor shaft 70 while the pivot shaft 98 to which the wiper arm is connected oscillates relative to the crank arm 94 and the lever arm 26 to thereby maintain a fixed angular orientation of the crank arm 94 relative to a horizontal or other fixed line. The long radius of the wiping path is effected by the oscillation of the pivot shaft 98 relative to the lever arm 26.

In the example shown the lever arm 26 oscillates through an angle of 130°. As the lever arm 26 oscillates the co-ordinating gear assembly 104 rotates with the shaft 98 because the chain is held stationary at the chain anchor 58 and the sprocket 100 effects rotation of the shaft 98. Rotation of the driving gear 105 meshing with the idler gear 120 causes the idler gear 122 fixed to the idler gear 120 to rotate about the fixed position idler shaft 118. The idler gear 122 in turn meshes with the gear 96 which drives the crank arm 94 because of its rigid attachment to the hollow shaft 90. At the same time the sprocket to which the pivot shaft 96 is rigidly secured causes rotation of the pivot shaft 98 and in turn rotation of the wiper arm drive lever 106, which rotation is transferred to a wiper arm which may be releasably secured thereto. The ratio of the various gears to one another is selected so that the crank arm 94 maintains a constant angular orientation relative to a fixed line. The crank arm 94 controls the drag link 20 which in turn controls the angular orientation of the link 124 which is fixed to and so maintains constant angular orientation relative to the wiper blade 16. In the preferred embodiment the wiper arm 18 maintains a motion wherein each position of the wiper blade 16 is parallel throughout the wiping path so as to provide a substantially rectangular pattern.

The chain anchor 58 is fixed but all of the remaining transmission parts including the sprocket 100 are movable with the lower housing 26*b* of the lever arm 26. Therefore the lower housing 26*b* can be adjusted longitudinally relative to the upper housing 26*a* and the chain anchor 58 to lengthen the distance between the axes of the pivot shaft 98 and the chain anchor 58. This properly tensions the chain 116 and thereby eliminates backlash. If looseness develops in the mechanism in service during the lifetime of the wiper set the transmission can be readjusted to the pre-load condition and zero backlash by merely loosening the clamping screws 34 and driving the tightening screw 42 against the shoulder 44. Adjustment of the position of the lug 59 by rotation of the adjustment plate 50 provides a means for setting the wiper arm and blade precisely at its desired parked position.

It is apparent that a windscreen wiper drive assembly has been provided for multiplying the effective length of the wiper arm with respect to its true length. The combination of a single chain for driving the wiper arm pivot shaft, with a geared torque transmitting arrangement for controlling a drag link crank arm, provides a light weight, efficient transmission with simplified adjustment means for eliminating backlash and looseness due to wear. Means are also provided for adjusting the geometry of the wiping pattern to park the wiper arm at precisely the desired park position. This precludes unnecessary interference with the driver's vision.

WHAT WE CLAIM IS:—

1. A windscreen wiper device assembly, for use in oscillating a wiper arm and a drag link which are pivotally connected at their outer ends to respective ends of a link which is itself maintained in constant angular orientation relative to a wiper

blade, the drive assembly comprising a support, a chain anchor fixed to said support, a prime mover having an oscillating output, a lever operatively connected adjacent its one end to said output for oscillatory movement about an axis coaxial with that of an arcuate part of said chain anchor, a pivot shaft rotatably mounted on said lever adjacent its other end, chain means secured to said chain anchor and operatively connected to said pivot shaft for causing oscillation of said pivot shaft relative to said lever when said lever is oscillating, means for securing the inner end of a radially extending wiper arm to said pivot for movement therewith, a radially extending crank arm pivotally mounted adjacent its one end on said lever for rotation about an axis coaxial with the axis of rotation of said pivot shaft, torque transmitting gear means operatively connecting said pivot shaft to said crank arm for effecting oscillation of said crank arm relative to said lever and said pivot shaft when said pivot shaft is oscillating relative to said lever to thereby maintain a constant angular orientation of said crank arm throughout its path relative to a fixed line, and means for pivotally securing the inner end of a radially extending drag link to said crank arm adjacent its other end, whereby the effective length of the wiper arm is a multiple of its true length to thereby increase the radius of the wiping path to produce a substantially quadrilateral wiping pattern.

2. A windscreen wiper drive assembly according to claim 1, wherein said chain means comprises a single chain anchored at each end to said chain anchor, and a chain sprocket fixed to said pivot shaft for rotation therewith, with said single chain looped about and engaging said sprocket.

3. A windscreen wiper drive assembly according to claim 1 or claim 2, wherein said torque transmitting gear means comprises a gear train having a driving gear fixed to said pivot shaft for rotation therewith, a driven gear operatively connected to said crank arm, and idler gearing intermediate and meshing with said driven gear and said driving gear.

4. A windscreen wiper drive assembly according to any one of claims 1 to 3, wherein said lever includes means for effecting lengthening or shortening adjustment thereof to thereby effect tensioning of said chain means.

5. A windscreen wiper drive assembly according to any one of claims 1 to 4, wherein said lever comprises a casing having an upper body and a lower body secured together, for longitudinal adjustment relative to each other, and means for retaining said bodies in adjusted position.

6. A windscreen wiper drive assembly according to claim 5, wherein one of said upper and lower bodies includes a base plate having a threaded lug protruding therefrom, a tightening screw threadably received in said threaded lug, a shoulder protruding from the other of said upper and lower bodies in alignment with said threaded lug, said tightening screw being positioned to engage said shoulder whereby longitudinal movement of said tightening screw towards said shoulder increases the length of said lever to effect increasing of tension on said chain means.

7. A windscreen wiper drive assembly according to any one of claims 1 to 6, wherein said support includes a support plate and adjustment means secured thereto for rotatably displacing said chain anchor about the axis of its arcuate part for adjusting the parked position of the wiper arm.

8. A windscreen wiper drive assembly according to claim 7, wherein said adjustment means comprises an adjustment plate pivotally mounted about said axis of the chain anchor, means for securing the chain anchor to the adjustment plate for movement therewith and means for retaining the adjustment plate in adjusted position relative to said support plate.

9. A windscreen wiper drive assembly according to claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1980.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1561813 COMPLETE SPECIFICATION

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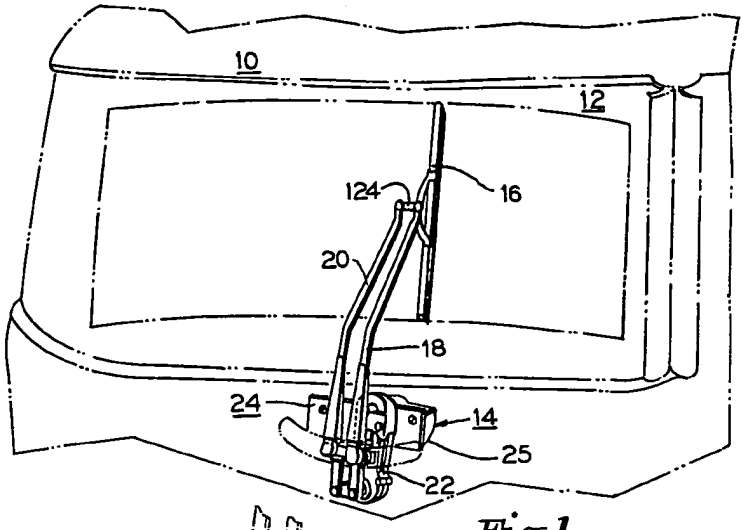

Fig. 1

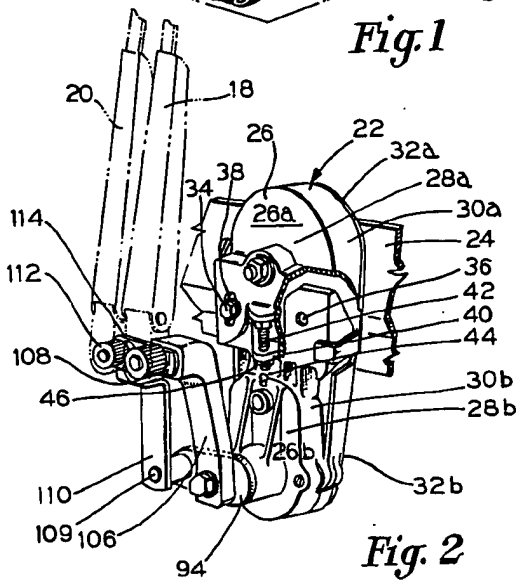

Fig. 2

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Sheet 2

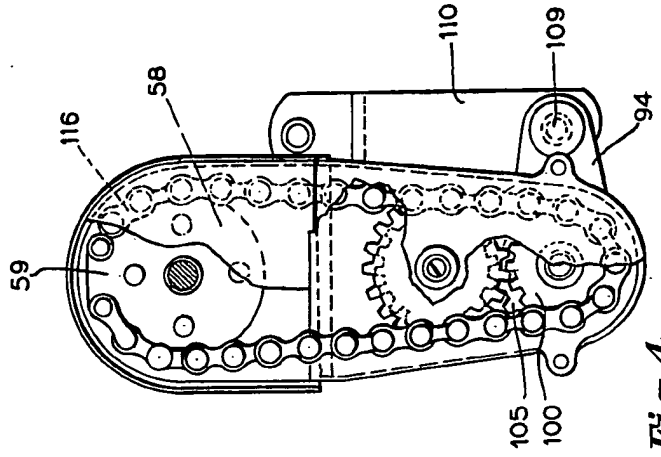

Fig. 4

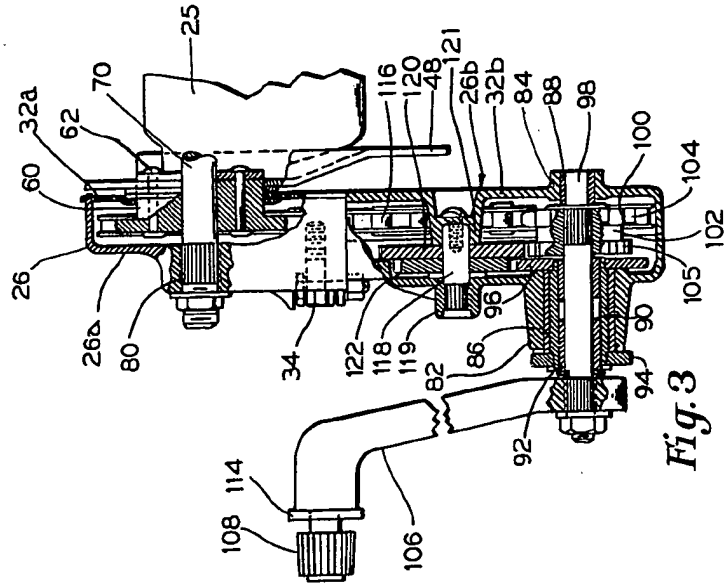

Fig. 3

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Sheet 3

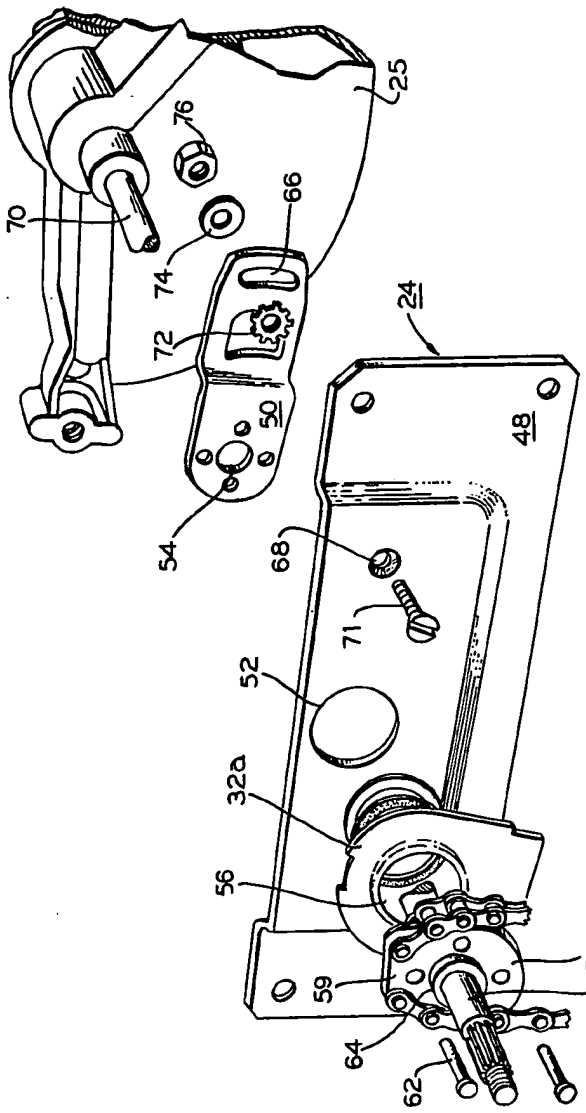

Fig.5